Quick assessment of soil organic carbon stocks for scaling up issues, using infrared spectroscopy on volcanic soils

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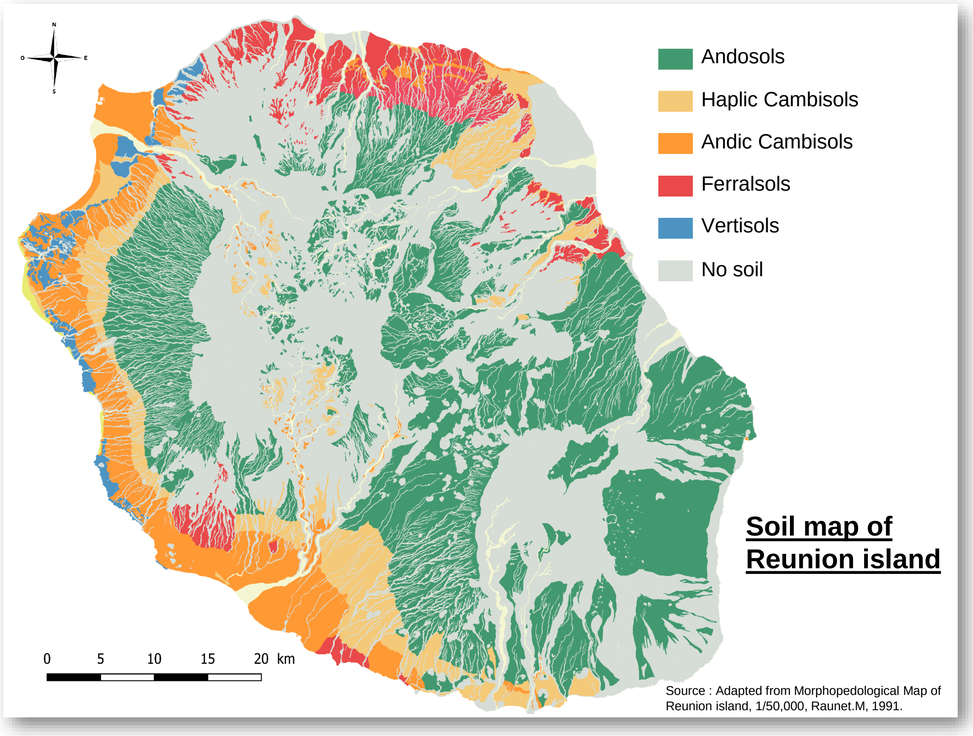
The 4 per 1000 initiative aims to increase the soil organic matter content and carbon sequestration

Assessing directly soil organic carbon (SOC) stocks in soils with spectroscopic techniques is a crucial methodological issue in monitoring SOC potential sequestration.

An interesting volcanic rock weathering gradient, from Andosols to Ferralsols, in **Reunion island**



AN INNOVATIVE METHOD

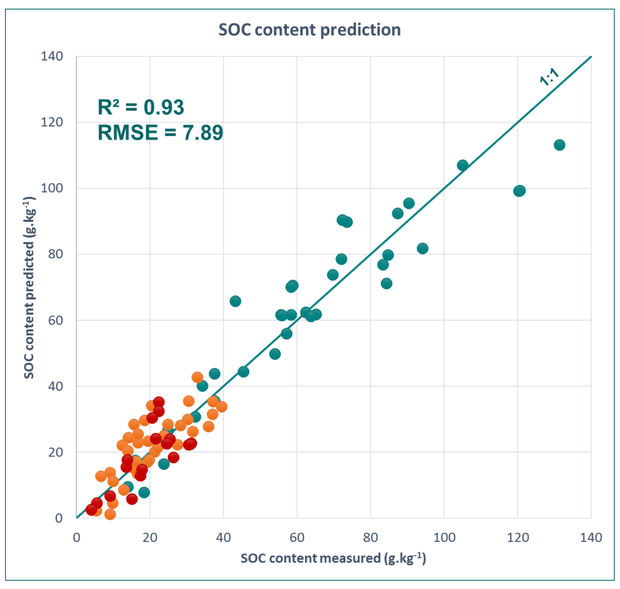
SPECTROSCOPY : A RAPID, LOW-COST AND HIGH TROUGHPUT ANALYSIS TO PREDICT SOC STOCKS

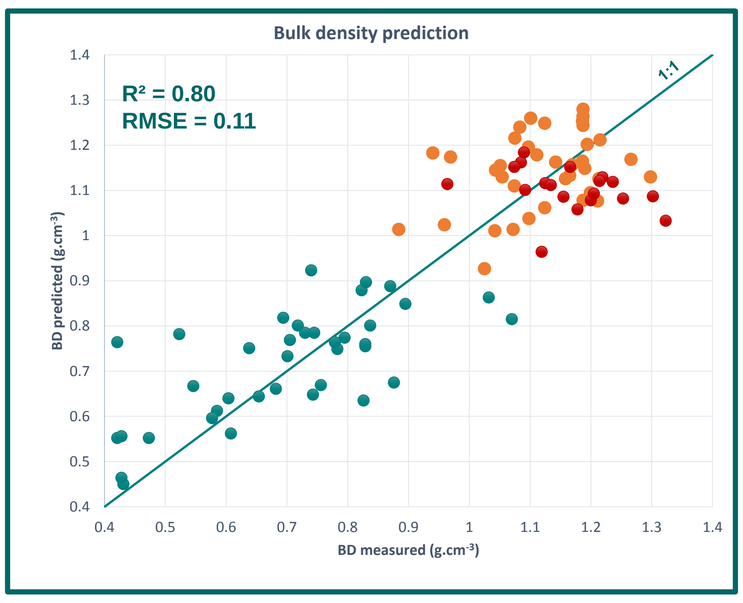
- 95 soil samples were collected in sugarcane and pasture plots across the island.
- Prediction models were developed with mid infrared spectroscopy (MIRS) on dried and thieved samples in the laboratory using PLS regression tools to assess SOC stocks.

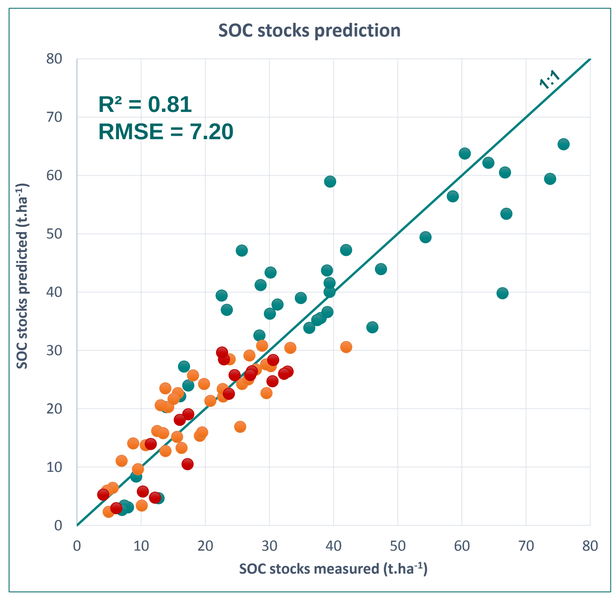
MIR spectra were recorded on an Agilent 4300 spectrometer, in the range 650 – 4000 cm^{-1}.

RESULTS: SOC STOCKS PREDICTION BY SPECTROSCOPY

C content * Bulk Density = SOC stocks







Andosol Cambisol Ferralsol

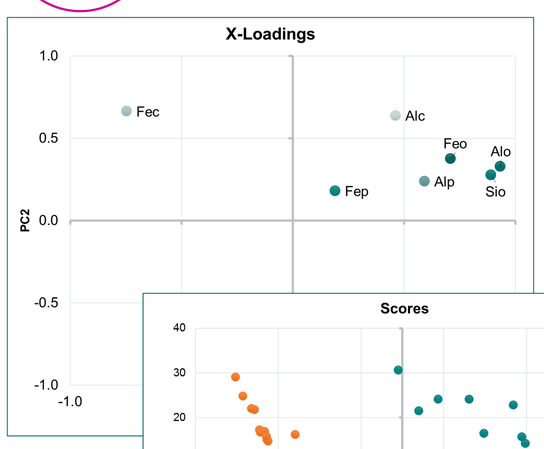
NONCRISTALLINE MINERALS, A PROXY OF BULK DENSITY FOR VOLCANIC SOILS?

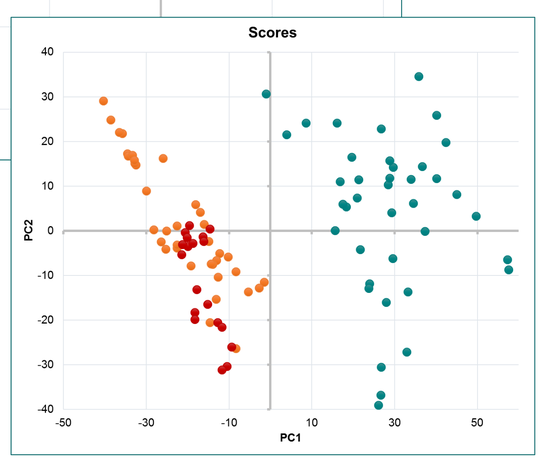
1 Laboratory analyses were performed to quantify short-range-ordered minerals and amorphous products.

2 Amorphous (Al & Si) products are precisely predicted by spectroscopy.

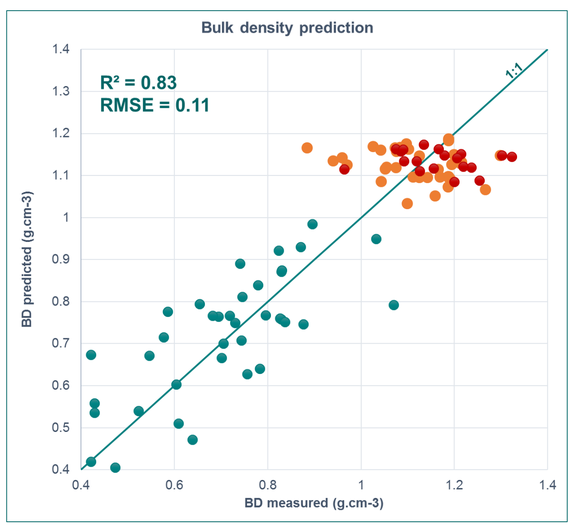
Noncristalline minerals	R^2	RMSE (‰)	RPD
Si oxalate	0.91	2.31	3.46
Al oxalate	0.91	6.25	3.23
Al pyrophosphate	0.82	2.07	2.34
Fe oxalate	0.77	4.12	2.30
Fe CBD	0.80	8.69	2.25
Al CBD	0.76	3.82	2.14
Fe pyrophosphate	0.70	3.11	2.06

3 Amorphous products discriminate the different volcanic soil types in Reunion island.





4 Bulk density prediction by amorphous products is particularly accurate.



CONCLUSION

SOC stocks can be predicted with satisfactory accuracy and directly by MIR spectroscopy in volcanic soils.